ITS Outputs in FY 2004

NTIA Publications

J.W. Allen, "Gain characterization of the RF measurement path," NTIA Report TR-04-410, Feb. 2004.

> In radio frequency (RF) measurements the gain (or loss) of the signal path connecting the measurement equipment to the measurement reference plane must be accounted for. This tutorial paper discusses the various definitions of gain, and how to determine the gain using either a calibrated signal generator, noise source, or network analyzer.

J.W. Allen, T.X Brown, D.C. Sicker, and J. Ratzloff (Eds.), "Proceedings of the International Symposium on Advanced Radio Technologies, March 2-4, 2004," NTIA Special Publication SP-04-409, Mar. 2004.

> No abstract available.

M.E. DeWeese, M.A. Luebs, and H.L. McCullough (Eds.), "Significant papers from the first 50 years of the Boulder Labs," NTIA Special Publication SP-04-416 and NIST IR 6618, Aug. 2004.

> The Department of Commerce Boulder Labs were dedicated on September 14, 1954, in the shadow of World War II, and at the dawn of a bright future. This volume presents a snapshot of our research accomplishments in the half century since then. During this time, the Boulder Labs have evolved from the National Bureau of Standards' Central Radio Propagation Laboratory to today's National Institute of Standards and Technology, National Oceanic and Atmospheric Administration, and National Telecommunications and Information Administration's Institute for Telecommunication Sciences. The papers we have collected represent the most significant work of all the agencies of the Boulder Labs, whatever their name at the time of publication.

P. Papazian and M. Cotton, "Relative propagation impairments between 430 MHz and 5750 MHz for mobile communication systems in urban environments," NTIA Report TR-04-407, Dec. 2003.

> Radiowave propagation measurements made in an urban area of Denver, Colorado, are described. Wideband, impulse response measurements were made at 4 carrier frequencies from 420 MHz to 5750 MHz. Basic transmission loss slope and delay spread statistics are used to characterize propagation conditions. By analyzing these results versus carrier frequency the relative propagation impairments for communication systems at 430, 1350, 2260 and 5750 MHz are compared. It was found that the path loss slope increased on average by 11 dB/decade and the delay spread decreased from 33% to 65% over the decade of frequencies measured.

M.H. Pinson and S. Wolf, "The impact of monitor resolution and type on subjective video quality testing," NTIA Technical Memorandum TM-04-412, Mar. 2004.

> This document compares subjective video quality test results from a professional cathode ray tube (CRT) television monitor with that of a consumer liquid crystal display (LCD) video phone monitor. The CRT monitor supported the full ITU R Recommendation BT.601 resolution (720 x 486) while the LCD monitor only supported Common Intermediate Format (CIF) resolution (352 x 288). The subjective results from the two tests are very similar, with the only significant difference being that the CIF monitor masks impairments that appear in only one of the two interlaced fields.

S. Wolf, "Color correction matrix for digital still and video imaging systems," NTIA Technical Memorandum TM-04-406, Dec. 2003.

> This document discusses a method for correcting inaccurate color output by digital still and video imaging systems. The method uses a known reference image together with a least squares algorithm to estimate the optimal color channel mixing matrix that must be applied to the output images in order to correct their color inaccuracies. The techniques presented in this document will provide users of digital photography and video equipment with an automated tool for correcting color output. For instance, digital photography users currently may try to correct color distortions in their images by trial and error using photo editing software.

However, these correction procedures are time consuming and subjective and do not normally allow for arbitrary mixing of the color channels. The automated color correction matrix computation presented in this document allows each color component in the corrected image (e.g., red) to be calculated as a linear summation of a DC component and all the color components (e.g., red, green, and blue) in the uncorrected image. Methods to correct non linearities in the color response of digital imaging systems are also discussed.

Outside Publications

Articles in Conference Proceedings

R.A. Dalke, "Analytical description of time and spectral characteristics of ultrawideband signals," in *Proc. of Wireless 2004: The 16th International Conference on Wireless Communications,* Calgary, Jul. 2004.

A variety of communications devices using ultrawideband (UWB) signals have been proposed. An understanding of the effects of such devices on more traditional RF systems is essential to both system designers and regulators. The Institute for Telecommunication Sciences has analyzed the characteristics of UWB signals from a variety of proposed devices. In this paper we describe the statistical characteristics of emissions from a fixed time-base dithered UWB device based on a theoretical analysis of the emitted signal.

J. Kub and E. Nelson, "LabVIEW with databases automates testing of land mobile radios for public safety," finalist, Virtual Instrumentation Applications paper contest, NIWeek 2004, Austin, TX, Aug. 2004.

Public Safety agencies at all levels of government (federal, state, local, and tribal) rely upon land mobile radios (LMRs) for day-to-day and emergency wireless communications. The advent of digital Project 25 LMRs has forced system designers to exhaustively characterize the interactions between Project 25 and legacy analog systems. These interference rejection tests, performed manually, were time-consuming and are prone to human error. However, the use of NI LabVIEW automation ensured accurate, cost-effective, and repeatable results through the use of a database library of selectable GPIB and RS-232 instrument commands and database measurement reporting.

G. Patrick, C. Hoffman, and R. Matheson, "Signal capacity modeling for shared radio system planning," in "Proceedings of the International Symposium on Advanced Radio Technologies: March 2-4, 2004," J.W. Allen, T.X Brown, D.C. Sicker, and J. Ratzloff (Eds.), NTIA Special Publication SP-04-409, Mar. 2004.

Almost every major Federal agency operates an independent mobile radio system in the 162-174 MHz band to provide critical radio communications with its own agents. Last year, NTIA began a joint OSM/ITS Spectrum Efficiency Initiative, which includes a study of whether a shared radio system (e.g., a trunked system) could functionally and advantageously replace most of the specialized single-agency radio systems. The first phase of this work is to understand the amount of service provided by the current single-agency radio systems. A "signal capacity model" was developed, which uses Federal Government Master File (GMF) license data to calculate the number of independent radio signals that could be received by a mobile user at 1-mile increments within a 100-mile radius of Washington, D.C. Since various radio network architectures transmit the same signal from multiple sites, different algorithms were used to calculate the signal capacity for different types of mobile networks. Peak and average signal capacity maps were produced, based on different assumptions about the probable location of users. This data will form the basis for the design of possible alternatives for future shared radio systems.

S. Voran, "Compensating for gain in objective quality estimation algorithms," in *Proc. of the International Conference on Acoustics, Speech, and Signal Processing (ICASSP),* Montreal, May 2004.

When objectively estimating speech, audio, or video quality, it is often necessary to compensate for a system gain or to "gain match" two or more signals. One can take three views of a system, leading to three different definitions of gain, and three different gain compensation solutions: one that minimizes distortion, one that matches input-output power, and one that maximizes signal-todistortion ratio. We derive these three solutions, describe the algebraic and geometric relationships between them, and provide a generalized result that subsumes all three. We provide examples showing that these three

solutions do differ in practical quality estimation situations. We also report some of the gain compensation choices found in the quality estimation literature.

S.D. Voran, "A bottom-up algorithm for estimating time-varying delays in coded speech," in *Proc. of the 3rd International Conference on Measurement of Speech and Audio Quality in Networks (MESAQIN),* Prague, Czech Republic, May 2004.

In packetized speech transmission, end-to-end delay can vary, even over short timescales. Estimating the resulting speech delay histories is critical to diagnostic and quality estimation efforts. We present a new bottom-up algorithm for estimating time-varying speech delays. The bottom-up approach is well-suited to real-time implementation. The algorithm works with very low-rate codecs as well as the higher-rate codecs that are more common in VoIP applications. We describe the new algorithm in some detail and provide descriptions of the databases and techniques used to develop and test the new algorithm.

Journal Articles

M.H. Brill, J. Lubin, P. Costa, S. Wolf, and J. Pearson, "Accuracy and cross-calibration of video quality metrics: New methods from ATIS/T1A1," *Signal Processing: Image Communication 19*, No. 2, pp. 101-107, Feb. 2004.

Video quality metrics (VQMs) have often been evaluated and compared using simple measures of correlation to subjective mean opinion scores from panels of observers. However, this approach does not fully take into account the variability implicit in the observers. We present techniques for determining the statistical resolving power of a VQM, defined as the minimum change in the value of the metric for which subjective test scores show a significant change. Resolving power is taken as a measure of accuracy. These techniques have been applied to the video quality experts group (VQEG) data set and incorporated into the recent Alliance for Telecommunications Industry Solutions (ATIS) Committee T1A1 series of technical reports (TRs), which provide a comprehensive framework for characterizing and validating full-reference VQM. These approved TRs, while not standards, will enable the US telecommunications industry to incorporate VQMs into contracts and tariffs for compressed video distribution. New methods for assessing VQM accuracy and cross-calibrating VQMs are an integral part of the framework. These methods have been applied to two VQMs at this point: peak-signal-to-noise ratio and the version of Sarnoff's just noticeable difference metric (JNDmetrix®) tested by VQEG (Rapporteur Q11/12 (VQEG): Final report from the VQEG on the validation of objective models of video quality assessment, June 2000). The framework is readily extensible to additional VQMs.

P. McKenna and G. Hand, "Radio propagation models," *MissionCritical Communications 19,* No. 5, Jun. 2004.

It is difficult to provide reliable radio service in today's crowded spectrum. The use of more precise system design and spectrum management tools can help.

M.H. Pinson and S. Wolf, "A new standardized method for objectively measuring video quality," *IEEE Trans. on Broadcasting 50*, No. 3, pp. 312-322, Sep. 2004.

The National Telecommunications and Information Administration (NTIA) General Model for estimating video quality and its associated calibration techniques were independently evaluated by the Video Quality Experts Group (VQEG) in their Phase II Full Reference Television (FR-TV) test. The NTIA General Model was the only video quality estimator that was in the top performing group for both the 525-line and 625-line video tests. As a result, the American National Standards Institute (ANSI) adopted the NTIA General Model and its associated calibration techniques as a North American Standard in 2003. The International Telecommunication Union (ITU) has also included the NTIA General Model as a normative method in two Draft Recommendations. This paper presents a description of the NTIA General Model and its associated calibration techniques. The independent test results from the VQEG FR-TV Phase II tests are summarized, as well as results from eleven other subjective data sets that were used to develop the method.

Unpublished Presentations

N. DeMinco, "Prediction of near-field intensity for a radar phased array antenna," National Radio Science Meeting, URSI, Univ. of Colorado, Boulder, Jan. 2004.

C. Ford and G. Hand, "Propagation of VHF signals across rough oceans close to shore: A comparision of models," National Radio Science Meeting, URSI, Univ. of Colorado, Boulder, Jan. 2004.

R. Matheson, "Alternative spectrum management techniques," tutorial, International Symposium on Advanced Radio Technologies, March 2004.

R. Matheson, "Somewhere, over the spectrum: Overseeing the Nation's radio airwaves," Boulder Labs 50th Anniversary Lecture Series, Aug. 4, 2004.

R. Matheson, "Spectrum measurements," invited presentation, National Academy of Sciences, Committee on Wireless Technology Prospects and Policy Options, San Diego, Jul. 22, 2004.

F. Sanders, "Radar pulse measurements and implications for spectrum emission compliance," Tri-Service Radar Symposium, Albuquerque, NM, Jun. 21, 2004.

F. Sanders, "Radar spectrum measurement techniques and implications for the RSEC and spectrum efficiency," invited talk, Naval Research Laboratory workshops on radar spectrum allocation issues, radar emission and measurement standards, Washington, Oct. 21, 2003.

R. Stafford "Voice over Internet Protocol and the convergence of communications technologies," invited talk, Univ. of Colorado, Boulder, Jan. 29, 2004.

Conferences Sponsored by ITS

International Symposium on Advanced Radio Technologies (ISART 2004)

The International Symposium on Advanced Radio Technologies (ISART 2004) was held March 2-4, 2004. This symposium explores the current state of the radio art with an eye towards forecasting the use of wireless technology in the future. In order to accomplish this goal, ISART brings together a diverse collection of people from academia, business, and government agencies to discuss the interplay between technological "how-to," the possibilities and restrictions created by regulation and policy, and the economic motivation of the business world. For more information see: http://www.its.bldrdoc.gov/meetings/art/.

Standards Leadership Roles

David J. Atkinson, Technical Coordinator for the development of a Justice and Public Safety XML Data Model and Data Element Dictionary, through the XML sub-committee of the Global Justice Information Sharing Initiative's Infrastructure/ Standards Working Group.

Randall S. Bloomfield, Vice-Chair of the ISSI Task Group and Vice-Chair of the P25 Systems Architecture Working Group (both within the APCO Project 25 Interface Committee).

Paul M. McKenna, National Chair of U.S. contingent of ITU-R Study Group 3 (Radiowave Propagation); Chair of Drafting Groups 3J6 and 3M-3B.

William J. Pomper, Chair of APCO/NASTD/FED Project 25 Encryption Task Group; Member of TIA/TR-8 — Mobile and Personal Private Radio Standards Committee.

Timothy J. Riley, Member of Alliance for Telecommunications Industry Solutions (ATIS) committee WTSC-G3GRA (Wireless Technologies and Systems Committee — Radio Aspects of GSM/3G and Beyond) and issue champion for development of document addressing interference issues affecting wireless communication systems.

Frank Sanders, Chair of ITU-R Radar Correspondence Group (radar technical spectrum issues); Delegate to ITU-R Working Party 8B (radar spectrum allocation and sharing) and Joint Rapporteur Group 1A-1C-8B (radar spectrum efficiency issues).

Neal B. Seitz, Vice Chair of ITU-T Study Group 13 (Next Generation Networks); Chair of ITU-T Study Group 13 Working Party 4 (OAM and QoS); Vice Chair of ATIS Network Performance, Reliability, and Quality of Service Committee (PRQC — formerly ANSI-accredited Technical Subcommittee T1A1).

Arthur Webster, Co-chair of Video Quality Experts Group (VQEG); Rapporteur for Question 21/9 (Objective and subjective methods for evaluating conversational audiovisual quality in multimedia services) in ITU-T Study Group 9 (Integrated broadband cable networks and television and sound transmission); Chair of Joint Rapporteur Group on Multimedia Quality Assessment (JRG-MMQA).

Representative Technical Contributions

Contributions listed below are a sample of the extensive standards work that ITS does each year.

Emergency Telecommunications Service Projects (authors/editors include A. Webster)

- "User plane security guidelines and requirements for ETS," ANSI Standard, ATIS PRQC.
- "User plane priority levels in IP networks and services," ATIS TR, ATIS PRQC.
- "Requirements for preferential telecommunications over IPCablecom networks," J.260, ITU-T SG 9, went out for TAP, May 2004.
- "Specifications for preferential telecommunications over IPCablecom networks," DNR J.pref, ITU-T SG 9.
- Draft TR on user plane security requirements in next generation networks, ATIS PRQC.

High-power Radars and Spectrum Sharing (authors include F.H. Sanders)

- "Reduction of unwanted emissions of radar systems operating above 400 MHz," PDNR M.1314, ITU-R WP-8B.
- "Technical and operational characteristics and protection criteria of radiodetermination and meteorological radars in the 2 900-3 100 MHz band," PDNR M.1460, ITU-R WP-8B.
- "Test results illustrating the susceptibility of maritime radionavigation radars to emissions from digital communication and pulsed systems in the bands 2 900-3 100 and 9 200-9 500 MHz," DNR, ITU-R WP-8B

Quality of Service (authors include N.B. Seitz)

- "Mapping between ITU-T (Y.1541/Y.1221) and 3GPP (TS 23-107) QoS classes and traffic descriptors," ITU-T SG 13, WP 4, Feb. 2004.
- "Survey of IP network QoS architecture and protocol standardization activities," T1A1/2003-116 (T1S1/2003-440), May 2004.

APCO Project 25 (authors include R.S. Bloomfield)

- P25 end-to-end performance topics, ISSI TG and UNS (P25 P25/TR-8), Oct. 2003.
- ISSI (voice) measurement and performance topics, ISSI TG and UNS (P25 P25/TR-8), Jan. 2004.
- Discussion paper: "Approach for P25/TR-8 (IPPTG) documentation of ISSI interoperability test procedures," IPPTG (P25/TR-8), Jan. 2004.
- Discussion paper: "Approach for developing ISSI interoperability test procedures for voice operation in trunked systems," IPPTG (P25/TR-8), Jan. 2004.
- Issue I of planned new TIA/ANSI standard: Project 25 ISSI measurement methods for voice services, ISSI TG (P25/TR-8), Mar. 2004.
- Issue H of planned new TIA/ANSI standard: Project 25 ISSI performance specifications for voice services, ISSI TG (P25/TR-8), Mar. 2004.
- Discussion paper: "Proposal for IPPTG development of interoperability test procedures for P25 wide area services," IPPTG (P25/TR-8), Mar. 2004.
- ITS comments on "APCO P25 ISSI messages definition" Draft TIA-102.BACA, version 0, Oct. 16, 2003 (ISSIMsgDef_Draftv0_'031016), TR-8.19 (P25/TR-8), Mar. 2004.
- P25 end-to-end and ISSI performance issues, P25 UNS special meeting (P25/TR-8), May 2004.
- Discussion paper: "Selected issues as of June 8, 2004 on ISSI measurement methods for voice services draft standard," ISSI TG (P25/TR-8), Jun. 2004.
- Discussion paper: "Selected issues as of June 8, 2004 on ISSI performance recommendations for voice services draft standard," ISSI TG (P25/TR-8), Jun. 2004.
- ISSI measurement and performance update, ISSI TG (P25/TR-8), Jun. 2004.

Ultrawideband (authors include R. Achatz, M. Cotton, and R. Dalke)

- "Estimating and graphing the amplitude probability distribution function of complex-baseband signals,"IEEE 802.15.3a.

Video Quality (authors include S. Wolf, M. Pinson)

- "Objective perceptual video quality measurement techniques for digital cable television in the presence of a full reference," ITU-T Recommendation J.144R, approved Mar. 2004.
- "Methodological framework for specifying accuracy and cross-calibration of video quality Metrics (VQM)," ITU-T Recommendation J.149, approved Mar. 2004.